

AN 1996-304905 [31] WPIDS
DNN N1996-256420 DNC C1996-097069
TI Lead -free solder alloy for heat exchanger - comprises zinc , tin
, copper , silver , indium , antimony , nickel , iron
and bismuth for excellent strength.
DC J08 M23 P55 Q78
PA (MITG) MITSUI MINING & SMELTING CO LTD
CYC 1
PI JP 08132279 A 19960528 (199631)* 3p <--
JP 3091098 B2 20000925 (200051) 3p <--
ADT JP 08132279 A JP 1994-290362 19941101; JP 3091098 B2 JP 1994-290362
19941101
FDT JP 3091098 B2 Previous Publ. JP 08132279
PRAI JP 1994-290362 19941101
AB JP 08132279 A UPAB: 19960808
Solder alloy consists of: 1-15 weight% of Zn and **balance** of
Sn. Solder alloy pref. consists of: 1-15 weight%
of Zn, 3 weight% or less of Cu, 5 weight% or less of at least one of
Ag, In, Sb, Ni, Fe, and Bi, and
balance of Sn.
ADVANTAGE - The strength and creep strength are excellent, and the
galvanic corrosion of bronze is reduced. As solder alloy contains no Pb,
the heat exchanger using the solder alloy does not induce pollution.
Dwg.0/0

[0012] Example

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 08-132279

(43)Date of publication of application : 28.05.1996

(51)Int.Cl.

B23K 35/26
C22C 13/00
F28F 21/08

(21)Application number : 06-290362

(71)Applicant : MITSUI MINING & SMELTING CO
LTD

(22)Date of filing : 01.11.1994

(72)Inventor : KUBOTA KOHEI
NINOMIYA RYUJI
MIYAKE KOICHI
YAMAGUCHI HIROSHI

(54) SOLDER ALLOY FOR HEAT EXCHANGER

(57)Abstract:

PURPOSE: To obtain a solder alloy which has excellent strength and creep strength, a lower degree of electrolytic corrosion with brass and excellent corrosion resistance by specifying the compsn. of the solder alloy for heat exchangers.

CONSTITUTION: This solder alloy for heat exchangers made of copper and copper alloy consists of 1 to 15wt.% Zn and the balance Sn exclusive of inevitable impurities. The solder alloy may contain \leq 3wt.% Cu as well. The Zn is effective in improving the strength of the solder alloy and lowering the m.p. The Zn contributes to increase the creep strength as well. The effect is insufficient if the content is below 1wt.%. The m.p. rises and the wet spreadability and corrosion resistance are degraded if the content is over 15wt.%. The Cu is effective in increasing the creep strength and suppressing the phenomenon, known as solder erosion, that the fin materials, etc., of the materials to be joined melt into the solder and their thickness and strength decrease. The flow property of the solder material degrades and the use is difficult if the content exceeds 3wt.%.

LEGAL STATUS

[Date of request for examination] 06.08.1997

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application]

converted registration]

[Date of final disposal for application]

[Patent number] 3091098

[Date of registration] 21.07.2000

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

Copyright (C); 1998,2003 Japan Patent Office

* NOTICES *

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1] The copper and the solder for the heat exchangers made from a copper alloy which are characterized by consisting of Sn except for a remainder unescapable impurity Zn1 - 15wt%.

[Claim 2] The copper and the solder for the heat exchangers made from a copper alloy which are characterized by consisting of Sn except for less than [Cu3wt%] and a remainder unescapable impurity Zn1 - 15wt%.

[Claim 3] The copper and the solder for the heat exchangers made from a copper alloy which are characterized by consisting of Sn Zn1 - 15wt% except for less than [more than 1 sort 5wt%] and a remainder unescapable impurity at least among less than [Cu3wt%], and Ag, In, Sb, nickel, Fe and Bi.

[Translation done.]

* NOTICES *

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the solder for heat exchangers used for the assembly for the heat exchangers the detailed radiator for automobiles made from copper and a copper alloy, for car heaters, etc. about the solder for heat exchangers.

[0002]

[Description of the Prior Art] Generally the solder material of a Pb-Sn system is used for junction of the heat exchanger made from copper and a copper alloy. In the field of the car radiator or the car heater, Pb85 - 35wt%, the binary system alloy of Remainder Sn is used and many 85 - 60wt% things are used for a part especially for Pb.

[0003] However, when discarded [that the heat exchanger using solder with much Pb is cut, or is not carried out by shredder, either, or] by the outdoors, Pb will be eluted in soil and is a prevention-of-pollution top problem. Moreover, the joint between plate material and tube material etc. may receive thermal stress, and the defect in which carry out creep deformation, and cause severe corrosion in which the flower bloomed according to the potential difference of brass and solder, and a fin separates or a tube explodes [**** / causing leakage] may be produced.

[0004]

[Problem(s) to be Solved by the Invention] Let it be the final purpose for this invention to raise the dependability of heat exchangers, such as a car radiator and a car heater, for the purpose of offering the solder for heat exchangers which was moreover excelled in reinforcement and creep strength as compared with Pb-Sn system solder, and extent of the electric corrosion between brass excelled in little corrosion resistance excluding Pb which poses such a public nuisance top problem.

[0005]

[Means for Solving the Problem] This invention is based on the knowledge of choosing an alloying element in detail in order to obtain the alloy which is damp in copper and a copper alloy with Sn alloy of Sn base, and gives flare nature, and attains the above-mentioned purpose.

[0006] That is, the copper of this invention and the solder for the heat exchangers made from a copper alloy are characterized by consisting of Sn except for a remainder unescapable impurity Zn1 - 15wt%.

[0007] moreover, the copper of this invention and the solder for the heat exchangers made from a copper alloy - the above-mentioned presentation -- in addition, Cu -- less than [3wt%] -- you may contain.

[0008] furthermore, the copper of this invention and the solder for the heat exchangers made from a copper alloy -- Cu -- in addition, the inside of Ag, In, Sb, nickel, Fe, and Bi -- at least one or more sorts -- less than [5wt%] -- you may contain.

[0009] Zn raises the reinforcement of a solder and is effective in lowering the melting point. Moreover, creep strength is also raised. the content -- 1 - 15wt% -- it is 3 - 10wt% preferably. As for the effectiveness, less than [1wt%] is not enough as a content, the melting point goes up [a content] by 15wt% **, and wetting flare nature and corrosion resistance fall. Even if it adds further comparatively so much, it is rare to make potential into ** like Pb and to promote electric corrosion with brass. When soldering for the object for electronic ingredients or electrical and electric equipment is assumed conventionally, Zn will wet wet if it is added, since weak activity flux is used, and I hear that its flare nature is not enough, and it has been made into tramp elements. However, since strong activity flux is used for the assembly of heat exchangers, such as a car radiator and a car heater, although wetting flare nature falls a little compared with a Pb-Sn system, it is possible to

secure the wetting flare nature of usable extent.

[0010] Since Cu is effective in suppressing the phenomenon in which the fin material which is the jointed material which creep strength is made to ** and is called the so-called solder hoe ***** melts into solder, and becomes weak thinly, arbitration can be made to contain it. the content -- less than [3wt%] -- it is 0.1 - 1wt% preferably. a content -- 3wt(s)% -- super- -- ** -- the fluidity of ***** material falls and use becomes difficult.

[0011] Ag, In, Sb, nickel, Fe, and Bi raise the reinforcement of solder material, respectively, and since In and Bi are effective in raising wetting flare nature, arbitration can be made to contain them further. The content is less than [5wt%]. If a content exceeds 5wt(s)%, the semantics which effectiveness is saturated and is made to contain more than it will be lost.

[0012]

[Example] Hereafter, based on an example etc., this invention is explained concretely.

The alloy of examples 1-3 and 1-25 sorts of examples of a comparison was first ingoted as follows.

(1) Presentation : 8.9wt%Zn, Remainder Sn, melting point:198 degree C (example 1).

(2) Presentation : 8.9wt%Zn, 0.5wt%Cu, Remainder Sn, melting point:198 degree C (example 2).

(3) Presentation : 8.9wt%Zn, 0.5wt%Cu, 0.3wt%Sb, Remainder Sn, melting point:198 degree C (example 3).

(4) Presentation : 72wt%Pb, Remainder Sn, melting point:265 degree C (example 1 of a comparison), (5) presentation: pure Sn, melting point:232 degree C (example 2 of a comparison).

In addition, the above-mentioned melting point was respectively measured from each state diagram.

[0013] Each was cast from temperature higher 100 degrees C than the melting point to metal mold, the round bar with a diameter of 20mm was obtained, and the piece of a mechanical test etc. was extracted (sample offering sample).

[0014] ** For 2 and 53% of elongation with a tensile strength of 77Ns [/mm], and an example 2, 2 and 49% of elongation with a tensile strength of 77Ns [/mm], and an example 3 were the result of a tension test / the example 1 / 2 and 25% of elongation with a tensile strength of 43Ns [/mm], and the example 2 of a comparison of 2 and 46% of elongation with a tensile strength of 78Ns [/mm], and the example 1 of a comparison] tensile strength 2 and 55% of elongation of 25Ns/mm.

[0015] ** 4.7Ns /of constant stress of 2 were hung mm under the 130-degree C environment, and the amount of creep elongation was measured. The diameters of the load section were 2mm and 1.5mm of parallel parts. a result -- the example 1 has fractured the examples 1-2 of a comparison within 67 hours, although 0.06mm elongation and the example 3 of 0.26mm elongation and an example 2 were 0.04mm elongation 67 hours after after 67 hours after.

[0016] ** From the melting point, Cu70wt% which carried flux 0.4ml which consists of saturation ZnCl₂ solution, a solder metal, or 0.3g (sample offering sample) of alloys on the Sn-Pb bath set as the temperature on 50 degrees C, the Zn30wt% brass plate was carried, it wetted wet, and flare nature was investigated. Although wetting flare nature was most excellent in the example 1 of a comparison, any solder metal or alloy was also in the good wetting condition.

[0017] ** Hot dipping was respectively carried out to lower half 3cmx3cm of the 3cmx6cm brass plate of four sheets with the solder metal or alloy (sample offering sample) of examples 1-3 and the examples 1-2 of a comparison, and it was immersed in the form where each brass plate is separately sunk in 5%NaCl solution for 90 hours. After the trial, the solder metal or the alloy was washed with the sulfuric acid 10%, and corrosion weight loss was calculated. For 30mg and an example 2, 31mg and an example 3 were [corrosion weight loss / the example 1 / 50mg and the example 2 of a comparison of 30mg and the example 1 of a comparison] 26mg. The bottom of the beaker immersed in the example 1 of a comparison was notably covered with white deposit.

[0018] ** Two brass pieces were soldered with the solder metal or alloy of examples 1-3 and the examples 1-2 of a comparison, and the superposition joint of 1cm angle was created. Since soldering conditions were made into the conditions held for 15 minutes at temperature with a melting point of +50 degrees C, they are conditions from which an alloy layer develops. The both ends of brass were pulled, lengthened and removed with the tension tester, and the force was investigated. Although physical semantics attachment was difficult since the reinforcement to which the soundness of an alloy layer, the shearing strength of a solder, wetting area, etc. mixed and were joined came out, for 2010 Ns and an example 3, 2050 Ns and the example 1 of a comparison were [the result / the example 1 / 1700 Ns and an example 2 / 1690 Ns and the example 2 of a comparison] 1980Ns.

[0019]

[Effect of the Invention] As explained above, it excels in reinforcement and creep strength, Sn alloy solder of this invention also has little corrosion by electric corrosion with brass, and since Pb is not included, when it uses for heat exchangers, such as a car radiator and a car heater, cannot cause the public nuisance by Pb, but can offer the heat exchanger whose dependability improved accident, such as leakage of water, to the lifting for the pile reason.

[Translation done.]

* NOTICES *

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.**** shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

TECHNICAL FIELD

[Industrial Application] This invention relates to the solder for heat exchangers used for the assembly for the heat exchangers the detailed radiator for automobiles made from copper and a copper alloy, for car heaters, etc. about the solder for heat exchangers.

[Translation done.]

* NOTICES *

JPO and NCIPI are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

PRIOR ART

[Description of the Prior Art] Generally the solder material of a Pb-Sn system is used for junction of the heat exchanger made from copper and a copper alloy. In the field of the car radiator or the car heater, Pb85 - 35wt%, the binary system alloy of Remainder Sn is used and many 85 - 60wt% things are used for a part especially for Pb.

[0003] However, when discarded [that the heat exchanger using solder with much Pb is cut, or is not carried out by shredder, either, or] by the outdoors, Pb will be eluted in soil and is a prevention-of-pollution top problem. Moreover, the joint between plate material and tube material etc. may receive thermal stress, and the defect in which carry out creep deformation, and cause severe corrosion in which the flower bloomed according to the potential difference of brass and solder, and a fin separates or a tube explodes [**** / causing leakage] may be produced.

[Translation done.]

* NOTICES *

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

EFFECT OF THE INVENTION

[Effect of the Invention] As explained above, it excels in reinforcement and creep strength, Sn alloy solder of this invention also has little corrosion by electric corrosion with brass, and since Pb is not included, when it uses for heat exchangers, such as a car radiator and a car heater, cannot cause the public nuisance by Pb, but can offer the heat exchanger whose dependability improved accident, such as leakage of water, to the lifting for the pile reason.

[Translation done.]

* NOTICES *

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] Let it be the final purpose for this invention to raise the dependability of heat exchangers, such as a car radiator and a car heater, for the purpose of offering the solder for heat exchangers which was moreover excelled in reinforcement and creep strength as compared with Pb-Sn system solder, and extent of the electric corrosion between brass excelled in little corrosion resistance excluding Pb which poses such a public nuisance top problem.

[Translation done.]

* NOTICES *

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

MEANS

[Means for Solving the Problem] This invention is based on the knowledge of choosing an alloying element in detail in order to obtain the alloy which is damp in copper and a copper alloy with Sn alloy of Sn base, and gives flare nature, and attains the above-mentioned purpose.

[0006] That is, the copper of this invention and the solder for the heat exchangers made from a copper alloy are characterized by consisting of Sn except for a remainder unescapable impurity Zn1 - 15wt%.

[0007] moreover, the copper of this invention and the solder for the heat exchangers made from a copper alloy - the above-mentioned presentation -- in addition, Cu -- less than [3wt%] -- you may contain.

[0008] furthermore, the copper of this invention and the solder for the heat exchangers made from a copper alloy -- Cu -- in addition, the inside of Ag, In, Sb, nickel, Fe, and Bi -- at least one or more sorts -- less than [5wt%] -- you may contain.

[0009] Zn raises the reinforcement of a solder and is effective in lowering the melting point. Moreover, creep strength is also raised. the content -- 1 - 15wt% -- it is 3 - 10wt% preferably. As for the effectiveness, less than [1wt%] is not enough as a content, the melting point goes up [a content] by 15wt% **, and wetting flare nature and corrosion resistance fall. Even if it adds further comparatively so much, it is rare to make potential into ** like Pb and to promote electric corrosion with brass. When soldering for the object for electronic ingredients or electrical and electric equipment is assumed conventionally, Zn will wet wet if it is added, since weak activity flux is used, and I hear that its flare nature is not enough, and it has been made into tramp elements. However, since strong activity flux is used for the assembly of heat exchangers, such as a car radiator and a car heater, although wetting flare nature falls a little compared with a Pb-Sn system, it is possible to secure the wetting flare nature of usable extent.

[0010] Since Cu is effective in suppressing the phenomenon in which the fin material which is the jointed material which creep strength is made to ** and is called the so-called solder hoe ***** melts into solder, and becomes weak thinly, arbitration can be made to contain it. the content -- less than [3wt%] -- it is 0.1 - 1wt% preferably. a content -- 3wt(s)% -- super- -- ** -- the fluidity of ***** material falls and use becomes difficult.

[0011] Ag, In, Sb, nickel, Fe, and Bi raise the reinforcement of solder material, respectively, and since In and Bi are effective in raising wetting flare nature, arbitration can be made to contain them further. The content is less than [5wt%]. If a content exceeds 5wt(s)%, the semantics which effectiveness is saturated and is made to contain more than it will be lost.

[Translation done.]

* NOTICES *

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

EXAMPLE

[Example] Hereafter, based on an example etc., this invention is explained concretely.

The alloy of examples 1-3 and 1-25 sorts of examples of a comparison was first ingoted as follows.

- (1) Presentation : 8.9wt%Zn, Remainder Sn, melting point:198 degree C (example 1).
- (2) Presentation : 8.9wt%Zn, 0.5wt%Cu, Remainder Sn, melting point:198 degree C (example 2).
- (3) Presentation : 8.9wt%Zn, 0.5wt%Cu, 0.3wt%Sb, Remainder Sn, melting point:198 degree C (example 3).
- (4) Presentation : 72wt%Pb, Remainder Sn, melting point:265 degree C (example 1 of a comparison), (5) presentation: pure Sn, melting point:232 degree C (example 2 of a comparison).

In addition, the above-mentioned melting point was respectively measured from each state diagram.

[0013] Each was cast from temperature higher 100 degrees C than the melting point to metal mold, the round bar with a diameter of 20mm was obtained, and the piece of a mechanical test etc. was extracted (sample offering sample).

[0014] ** For 2 and 53% of elongation with a tensile strength of 77Ns [/mm], and an example 2, 2 and 49% of elongation with a tensile strength of 77Ns [/mm], and an example 3 were the result of a tension test / the example 1 / 2 and 25% of elongation with a tensile strength of 43Ns [/mm], and the example 2 of a comparison of 2 and 46% of elongation with a tensile strength of 78Ns [/mm], and the example 1 of a comparison] tensile strength 2 and 55% of elongation of 25Ns/mm.

[0015] ** 4.7Ns /of constant stress of 2 were hung mm under the 130-degree C environment, and the amount of creep elongation was measured. The diameters of the load section were 2mm and 1.5mm of parallel parts. a result -- the example 1 has fractured the examples 1-2 of a comparison within 67 hours, although 0.06mm elongation and the example 3 of 0.26mm elongation and an example 2 were 0.04mm elongation 67 hours after after 67 hours 67 hours after.

[0016] ** From the melting point, Cu70wt% which carried flux 0.4ml which consists of saturation ZnCl₂ solution, a solder metal, or 0.3g (sample offering sample) of alloys on the Sn-Pb bath set as the temperature on 50 degrees C, the Zn30wt% brass plate was carried, it wetted wet, and flare nature was investigated. Although wetting flare nature was most excellent in the example 1 of a comparison, any solder metal or alloy was also in the good wetting condition.

[0017] ** Hot dipping was respectively carried out to lower half 3cmx3cm of the 3cmx6cm brass plate of four sheets. with the solder metal or alloy (sample offering sample) of examples 1-3 and the examples 1-2 of a comparison, and it was immersed in the form where each brass plate is separately sunk in 5%NaCl solution for 90 hours. After the trial, the solder metal or the alloy was washed with the sulfuric acid 10%, and corrosion weight loss was calculated. For 30mg and an example 2, 31mg and an example 3 were [corrosion weight loss / the example 1 / 50mg and the example 2 of a comparison of 30mg and the example 1 of a comparison] 26mg. The bottom of the beaker immersed in the example 1 of a comparison was notably covered with white deposit.

[0018] ** Two brass pieces were soldered with the solder metal or alloy of examples 1-3 and the examples 1-2 of a comparison, and the superposition joint of 1cm angle was created. Since soldering conditions were made into the conditions held for 15 minutes at temperature with a melting point of +50 degrees C, they are conditions from which an alloy layer develops. The both ends of brass were pulled, lengthened and removed with the tension tester, and the force was investigated. Although physical semantics attachment was difficult since the reinforcement to which the soundness of an alloy layer, the shearing strength of a solder, wetting area, etc. mixed and were joined came out, for 2010 Ns and an example 3, 2050 Ns and the example 1 of a comparison were [the result / the example 1 / 1700 Ns and an example 2 / 1690 Ns and the example 2 of a comparison] 1980Ns.

[Translation done.]